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(52) UK CL (Edition L)

H4J JAB J30F J31H

(56) Documents cited

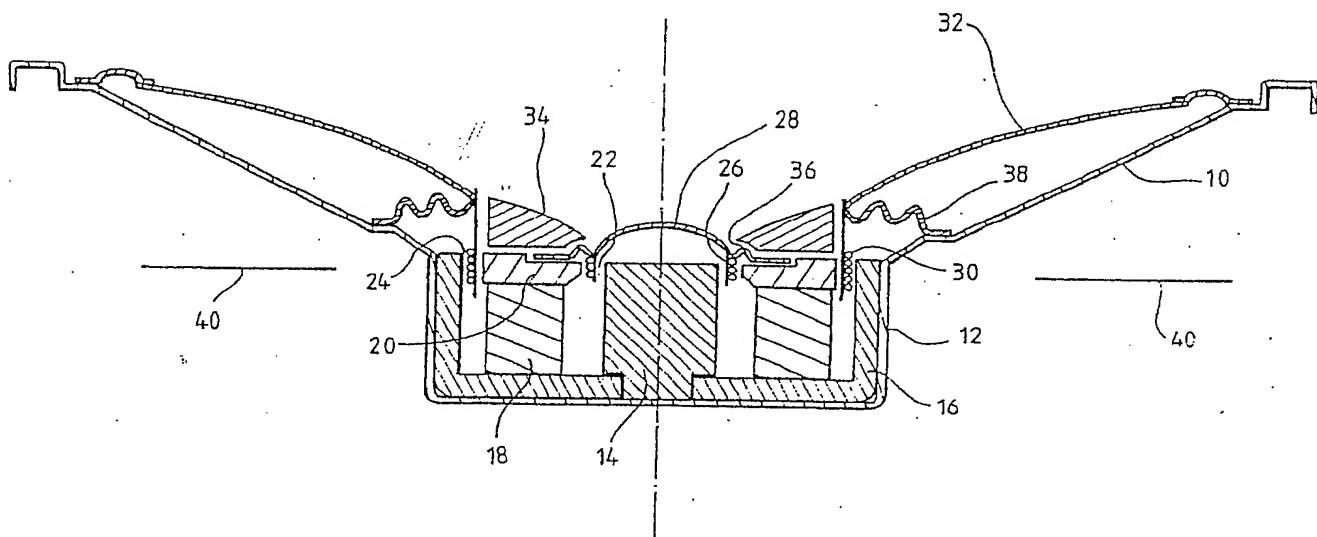
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| GB 0841666 A | GB 0767309 A | GB 0696852 A |
| GB 0665815 A | GB 0641651 A | GB 0469194 A |
| GB 0455208 A | GB 0445935 A | GB 0442900 A |
| GB 0308317 A | | |

(58) Field of search

UK CL (Edition K) H4J JAB JCA JEB JEX
 INT CL⁶ H04R 1/24 1/26 9/00 9/02 9/04 9/06 11/00
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 Online databases: WPI, CLAIMS

(54) A loudspeaker

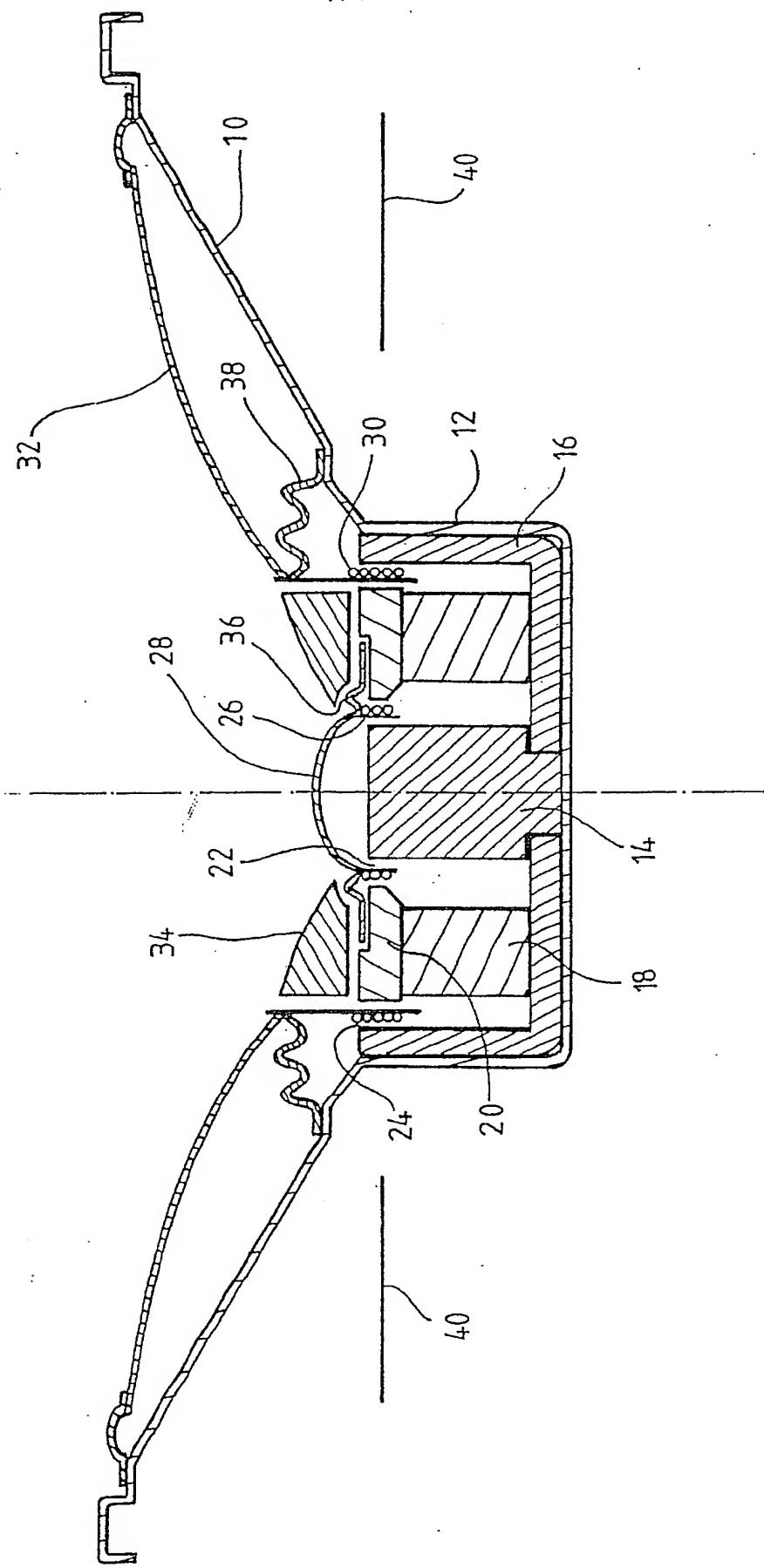
(57) A loudspeaker has treble and bass diaphragms 32, 28 combined in a single unit. The two diaphragms are driven by separate voice coils 30, 26 and the coils both move relative to a single magnet 18. Both coils lie in a common plane 40 perpendicular to the longitudinal axis of the loudspeaker.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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A LOUDSPEAKER

This invention relates to a loudspeaker, particularly a
loudspeaker for reproducing sounds over a wide frequency
5 range such as is required, for example, in reproducing
music.

It is well known to divide the audio frequency range and to
provide separate speaker components for dealing with
10 different parts of the frequency range. In a conventional
terminology "woofer" is a speaker which deals with the low
frequency (or bass sound) and a "tweeter" deals with the
high frequency (or treble) sounds.

15 In some installations, a separate woofer and separate
tweeter are mounted together in a single enclosure to cover
the full frequency range. In other known installations, the
woofer and the tweeter are combined together in a single
loudspeaker unit. Each loudspeaker unit has a diaphragm
20 connected to a voice coil. The voice coil is positioned in
an air gap traversed by lines of magnetic flux and as a
varying signal is passed to the voice coil, so the voice
coil is caused to move in the magnetic field resulting in
vibration of the diaphragm and the production of audible
25 sound.

In the known combination loudspeakers, it has been found
necessary to have one magnet system for the tweeter and a
second magnet system for the woofer. Since the tweeter
30 diaphragm and the woofer diaphragm are arranged coaxially,
it is then necessary for one magnet system to be behind the
other, as viewed along the axis of the loudspeaker. This is
disadvantageous in that the diaphragms for the two speakers
are also spaced from one another along the axis. As a
35 result the air vibrations produced by diaphragm movement of

the treble and bass diaphragms will be out of phase with one another, and this leads to a drop in the sound quality.

According to the present invention, there is provided a
5 loudspeaker having a bass voice coil, a bass diaphragm driven by the bass voice coil, a treble voice coil and a treble diaphragm driven by the treble voice coil, wherein both the bass and the treble voice coils are mounted for movement relative to a common plane at right angles to the
10 axis of the loudspeaker.

With this arrangement, the treble and bass voice coils can lie at the same point along the loudspeaker axis, so that it becomes possible to achieve a true single point acoustic
15 source for the reproduction of full range, linear phase and time-coherent sound quality.

The ring magnet preferably surrounds a first magnet pole piece and is surrounded by a second magnet pole piece, so
20 that two magnetic gaps are formed, one being of smaller diameter than the ring magnet and the other being of larger diameter.

Preferably the treble voice coil is arranged in the smaller
25 diameter magnetic gap, and the bass voice coil in the larger diameter gap. The treble diaphragm can be in the form of a dome at the centre of the loudspeaker, and the bass diaphragm can be in the form of a cone.

30 According to a second aspect of the invention, there is provided a loudspeaker having a bass voice coil a bass diaphragm driven by the bass voice coil, a treble voice coil, a treble diaphragm driven by the treble voice coil and a common ring magnet relative to which both the bass and
35 treble voice coils can move.

The invention will now be further described, by way of example, with reference to the accompanying drawing which shows a cross section through a loudspeaker in accordance with the invention.

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The loudspeaker shown in the drawing has a chassis 10. In a cup formation at the base 12 of the chassis is a soft iron pole piece 14 and a soft iron cup 16. An annular or ring magnet 18 is fitted between the pole 14 and the cup 16, and 10 supports an annular metal plate 20. The plate 20 defines an inner magnetic gap 22 with the pole piece 14 and an outer magnetic gap 24 with the cup 16.

In the inner gap 22, a treble voice coil 26 is positioned. 15 This coil drives a treble diaphragm 28 in the form of a dome. In the outer gap 24, a bass voice coil 30 is positioned, and this coil drives a bass diaphragm 32 in the form of a cone. A face plate 34 is fitted between the treble and bass diaphragms. The diaphragms 28 and 32 are 20 supported by conventional diaphragm suspension arrangements indicated at 36 and 38 respectively.

The signal feeds to the voice coils 26 and 30 will be provided in a conventional manner. However since both voice 25 coils oscillate about a common plane which is indicated in the drawing by the line 40, the air vibrations set up by the two diaphragms both emanate from the same plane and from the same point in that plane. Sound produced by both diaphragms will therefore be in phase and time-coherent.

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It is an additional advantage of this invention that the loudspeaker described here uses less separate components and is therefore cheaper to manufacture and easier to assemble than conventional combined treble/bass loudspeakers.

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CLAIMS

1. A loudspeaker having a bass voice coil, a bass diaphragm driven by the bass voice coil, a treble voice coil and a treble diaphragm driven by the treble voice coil, wherein both the bass and the treble voice coils are mounted for movement relative to a common plane at right angles to the axis of the loudspeaker.
- 10 2. A loudspeaker as claimed in Claim 21, wherein the ring magnet surrounds a first magnet pole piece and is surrounded by a second magnet pole piece, so that two magnetic gaps are formed, one being of smaller diameter than the ring magnet and the other being of larger diameter.
- 15 3. A loudspeaker as claimed in Claim 1 or Claim 2, wherein the treble and bass voice coils both vibrate relative to a common plane which is perpendicular to the axis of the ring magnet.
- 20 4. A loudspeaker as claimed in any preceding claim, wherein the treble and bass diaphragms are coaxial.
- 25 5. A loudspeaker as claimed in Claim 4, wherein the treble diaphragm is located within the bass diaphragm.
- 30 6. A loudspeaker having a bass voice coil, a bass diaphragm driven by the bass voice coil, a treble voice coil, a treble diaphragm driven by the treble voice coil, and a common ring magnet relative to which both the bass and treble voice coils can move.
7. A loudspeaker substantially as herein described with reference to and as shown in the accompanying drawing.

Patents Act 1977

Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

9123291.8

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| Relevant Technical fields | Search Examiner |
| (i) UK CI (Edition K) H4J (JAB, JCA, JEB, JEX) | P J EASTERFIELD |
| (ii) Int CI (Edition 5) H04J 1/24, 1/26, 9/00, 9/02, 9/04, 9/06, 11/00, 11/02 | |
| Databases (see over) | Date of Search |
| (i) UK Patent Office | |
| (ii) ONLINE DATABASES: WPI, CLAIMS | 27 FEBRUARY 1992. |

Documents considered relevant following a search in respect of claims

1 TO 6

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|------------------------|---|-------------------------|
| X | GB 0841666 A (SWIFT LEVICK) whole document | 1 to 6 |
| X | GB 0767309 A (GOODMANS) whole document | 1 to 6 |
| X | GB 0696852 A (GOODMANS) whole document | 1 to 6 |
| X | GB 0665815 A (MARCONI) whole document | 1 to 6 |
| X | GB 0641651 A (CHAPMAN) whole document | 1,3 to 6 |
| X | GB 0469194 A (WEEKS) whole document | 1,3 to 6 |
| X | GB 0455208 A (SHARP AND MCGRATH) see Figure 1 | 1,3 to 6 |
| X | GB 0445935 A (EVANS) see Figures 1,2,3 | 1 to 6 |
| X | GB 0442900 A (ENGLISH STEEL) whole document | 1 to 6 |
| X | GB 0308317 A (MARCONI) whole document | 1 to 6 |

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| Category | Identity of document and relevant passages | Relevant to claim(s) |
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Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).